

Contents

I. GENERAL THEORY - The First Law	1
1. Nature and Scope of Thermodynamics	1
2. Explanatory Remarks about the Method of Partitions and Enclosures	4
3. Conceptual Tools: Partitions	8
4. The Zeroth Law of Thermodynamics	12
5. The Empirical Temperature	14
6. Conceptual Tools: Phase Space and the Set of Points α	20
7. A Restricted Form of the First Law and the Quantitative Measure of Heat	23
8. Generalizations: Energy and the Set of Points β	29
II. GENERAL THEORY - The Second Law	35
9. Quasistatic Processes	35
10. The 'Interior' (γ) of a Set of Points β	45
11. The Connection between Quasistatic Adiabatic Accessibility and the Existence of an Integrating Factor for $d'Q$ in a Set γ	50
12. The Existence of an Entropy and an Absolute Temperature Function	53
13. The Extent to which Certain Arbitrary Choices can Affect the Properties of Entropy and Absolute Temperature	64
14. The Changes of Entropy in Non-Static Adiabatic Processes	77
15. Survey of Physical Processes	90
III. GENERAL THEORY - The Third Law	96
16. Deducible Properties of the Hypersurface $T = 0$	96
17. The Boundary of Sets β : Unattainability Principles	99
18. Entropy Properties Engendered by the Unattainability of the Absolute Zero	104
19. Axiomatics	105
IV. BASIC APPLICATIONS AND EXTENSIONS	121
20. The Empirical Determination of Entropy and Absolute Temperature Scales from Quasistatic Processes in Special Systems	121
21. 'Simple' Systems: The Extension of Thermodynamics to Open and Non-Equilibrium Systems	128

22. Compound Systems	143
23. Application to Chemical Thermodynamics: The Properties of Phases	152
24. Additional Thermodynamic Functions and their Properties	159
25. Thermodynamic Cycles, and Principles Associated with their Study	170
26. The Ideal Classical Gas	184
27. The Ideal Quantum Gas	201

V. COMBINATIONS OF THERMODYNAMICS AND STATISTICAL MECHANICS 217

28. Statistical Mechanics of the Ideal Gases; General Theory	217
29. Density of States Formulae; Black-Body Radiation	250
30. Non-Black-Body Radiation	291
31. Statistical Mechanics of the Ideal Quantum Gases; Special Topics	306
32. Paramagnetics: Systems Having Two Sets γ Contained in One Set β	329
33. Descriptions which are Intermediate between Thermodynamics and Statistical Mechanics: Temperature-Dependent Energy Levels	343
34. Relations among Statistical Mechanical Principles using the Method of Transition Probabilities	356
35. Thermodynamics as a Precursor of Quantum Mechanics	372

APPENDICES

A. Comments on the Mode of Treatment Adopted	381
B. The Reduction of Pfaffians to Canonical form	392
C. Two Basic Results in Statistical Mechanics	401
D. The Continuous Spectrum Approximation in the Theory of the Quantum Gases	425
E. The Use of the Canonical Distribution in the Theory of the Quantum Gases	432
F. The Method of the Enumeration of States and Most Probable Distributions in the Theory of the Quantum Gases	445
G. Discussion of the Master Equation	463

BIBLIOGRAPHY 476

AUTHOR INDEX 481

SUBJECT INDEX 485